

CLAIMS:

Sub A1> 1. A universal joint comprising:

- (a) first and second rings;
- (b) first and second yokes disposed within the first and second rings, respectively;
- 5 (c) first and second shafts;
- (d) first pin means pivotally interconnecting the first yoke and the first ring;
- (e) second pin means pivotally interconnecting the first shaft and the first ring;
- (f) third pin means pivotally interconnecting the second yoke and the second ring;
- (g) fourth pin means interconnecting the second shaft and the second ring;
- 10 (h) a coupling means interconnecting the first yoke and the second yoke;
- (i) a plurality of bearing means receiving the pin means; and
- (j) centering means interconnecting the first shaft and the second shaft, the centering means comprising a first cam rod rotatably coupled to a second cam rod.

2. The universal joint of claim 1, wherein there are bearing means in each ring, the bearing means in the first ring receiving the first second pin means, and the bearing means in the second ring receiving the third and fourth pin means.

3. The universal joint of claim 1, wherein:

the first cam rod includes a first section having a first axis of rotation and a second section, offset from the first section, having a second axis of rotation; and

20 the second cam rod includes a first section having a first axis of rotation and a second section, offset from the first section, having a second axis of rotation.

4. The universal joint of claim 3, wherein:

the first and second pin means have pivot centers and the third and fourth pin means have pivot centers; and

25 the axes of rotation of the first cam rod intersect the pivot centers of the first and second pin means and the axes of rotation of the second cam rod intersect the pivot centers of the third and fourth pin means.

30 5. The universal joint of claim 1, wherein the first and second pin means have pivot centers and the third and fourth pin means have pivot centers, the first cam rod has axes of rotation and the second cam rod has axes of rotation, and the axes of rotation of the first cam rod intersect the pivot

centers of the first and second pin means and the axes of rotation of the second cam rod intersect the pivot centers of the third and fourth pin means.

6. The universal joint of claim 1, further comprising a cam tube which receives and supports the cam rods, wherein both cam rods are rotatably supported at equal angles within the

5 cam tube.

7. A universal joint comprising:

- (a) first and second shafts;
- (b) coupling means for transmitting torque from the first shaft to the second shaft;
- (c) centering means interconnecting the first shaft and the second shaft for causing the second shaft

10 to move at the same angle relative to the coupling means as does the first shaft, the centering means comprising a first cam rod and a second cam rod rotatably coupled to the first cam rod.

8. The universal joint of claim 7, wherein each cam rod includes a first straight section and a second straight section, each straight section having a longitudinal axis, and the longitudinal axes of the two straight sections forming an angle, and the angle of the first cam rod is equal to the

15 angle of the second cam rod.

9. The universal joint of claim 8, further comprising a cam tube, and wherein both cam rods are rotatably supported at equal angles within the cam tube.

10. The universal joint of claim 9, wherein the cam tube includes bores which support the cam rods at equal angles to each other, and which are the same angle as the cam rods, such that

20 when rotating the coupled cam rods within the cam tube, the axes of the second straight sections of the cam rods can align themselves to one another or can be misaligned with respect to one another up to an angle equal to four times the angle of the cam rod.

11. The universal joint of claim 1, wherein: the first cam rod is rotatably coupled to the second cam rod by a pin and cube universal joint which is supported within a cam tube.

25 12. A universal joint comprising:

- (a) first and second shafts;
- (b) coupling means for transmitting torque from the first shaft to the second shaft;
- (c) centering means interconnecting the first shaft and the second shaft for causing the second shaft

30 to move at the same angle relative to the coupling means as does the first shaft, the centering means comprising a first cam rod and second cam rod longitudinally aligned at equal angles within a cam tube.

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13. A universal joint comprising:

- (a) first and second shafts;
- (b) coupling means for transmitting torque from the first shaft to the second shaft;
- (c) centering means interconnecting the first shaft and the second shaft for causing the second shaft to move at the same angle relative to the coupling means as does the first shaft, the centering means comprising a first cam rod and a second cam rod longitudinally aligned with and rotatably connected to the first cam rod by a plurality of bent rods.

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14. The universal joint of claim 13, wherein the first cam rod and the second cam rod are connected at equal angles, and the axes of rotation of the first cam rod, bent rods and second cam rod intersect at the pivot points of the first and second shafts and the bisecting plane of the universal joint which is perpendicular to the rotation axes of the coupling means.

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15. The universal joint of claim 13, further comprising a cam tube rotatably supporting the first cam rod and the second cam rod, and whereby the first cam rod, the second cam rod, and the cam tube rotatably support and interconnect the first shaft and the second shaft for causing the second shaft to move at the same angle relative the coupling means as does the first shaft.

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16. A universal connector comprising:

- (a) a first cam rod;
- (b) a second cam rod;
- (c) a cam tube, wherein the first cam rod is rotatably coupled to the second cam rod, and wherein both cam rods are rotatably supported at equal angles within cam tube;
- (d) connection means for connecting the first cam rod to a first member and for connecting the second cam rod to a second member.

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17. The connector of claim 16, wherein the first and second members are shafts.

18. The connector of claim 16, wherein the first and second members are tubes.

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19. The connector of claim 16, wherein the first and second members are construction members.

20. A universal joint comprising:

- (a) first and second rings, each ring comprising a plurality of ring segments which are fitted together end-to-end in a manner to mechanically retain the ring segments together;
- (b) first and second yokes disposed within the first and second rings, respectively;
- (c) first and second shafts;

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(d) first pin means pivotally interconnecting the first yoke and the first ring;

(e) second pin means pivotally interconnecting the first shaft and the first ring;

(f) third pin means pivotally interconnecting the second yoke and the second ring;

(g) fourth pin means interconnecting the second shaft and the second ring;

5 (h) a coupling means interconnecting the first yoke and the second yoke;

(i) a plurality of bearing means receiving the pin means.

21. The universal joint of claim 20, wherein the ring segments are quadrants.

22. The universal joint of claim 21, wherein the quadrants are substantially identical to one another.

10 23. The universal joint of any one of claims 20-22, further comprising centering means interconnecting the first shaft and the second shaft, the centering means comprising a first cam rod and a second cam rod rotatably coupled to the first cam rod.

24. The universal joint of claims 23, wherein the second cam rod is longitudinally aligned with and rotatably connected to the first cam rod by a plurality of bent rods.

15 25. A centering means for a universal joint comprising first and second-shafts and a coupling means for transmitting torque from the first shaft to the second shaft, the centering means including means for interconnecting the first shaft and the second shaft for causing the second shaft to move at the same angle relative to the coupling means as does the first shaft, the centering means comprising a first cam rod and a second cam rod rotatably coupled to the first cam rod.

20 26. The centering means of claim 25, wherein each cam rod includes a first straight section and a second straight section, each straight section having a longitudinal axis, and the longitudinal axes of the two straight sections forming an angle, and the angle of the first cam rod is equal to the angle of the second cam rod.

25 27. The centering means of claim 26, further comprising a cam tube, and wherein both cam rods are rotatably supported at equal angles within the cam tube.

28. The universal joint of claim 27, wherein the cam tube includes bores which support the cam rods at equal angles to each other, and which are the same angle as the cam rods, such that when rotating the coupled cam rods within the cam tube, the axes of the second straight sections of the cam rods can align themselves to one another or can be misaligned with respect to one another up to an angle equal to four times the angle of the cam rod.

29. The invention of any preceding claim, wherein there are bearing means in each ring, the bearing means in the first ring receiving the first second pin means, and the bearing means in the second ring receiving the third and fourth pin means.

30. The invention of any preceding claim, wherein:

5 the first cam rod includes a first section having a first axis of rotation and a second section, offset from the first section, having a second axis of rotation; and

the second cam rod includes a first section having a first axis of rotation and a second section, offset from the first section, having a second axis of rotation.

31. The invention of claim 30, wherein:

10 the first and second pin means have pivot centers and the third and fourth pin means have pivot centers; and

the axes of rotation of the first cam rod intersect the pivot centers of the first and second pin means and the axes of rotation of the second cam rod intersect the pivot centers of the third and fourth pin means.

15 32. The invention of any preceding claim, wherein the first and second pin means have pivot centers and the third and fourth pin means have pivot centers, the first cam rod has axes of rotation and the second cam rod has axes of rotation, and the axes of rotation of the first cam rod intersect the pivot centers of the first and second pin means and the axes of rotation of the second cam rod intersect the pivot centers of the third and fourth pin means.

20 33. The invention of any preceding claim, further comprising a cam tube which receives and supports the cam rods, wherein both cam rods are rotatably supported at equal angles within the cam tube.

25 34. The invention of any preceding claim, wherein each cam rod includes a first straight section and a second straight section, each straight section having a longitudinal axis, and the longitudinal axes of the two straight sections forming an angle, and the angle of the first cam rod is equal to the angle of the second cam rod.

35. The invention of any preceding claim, further comprising a cam tube, and wherein both cam rods are rotatably supported at equal angles within the cam tube.

30 36. The invention of claim 35, wherein the cam tube includes bores which support the cam rods at equal angles to each other, and which are the same angle as the cam rods, such that when rotating the coupled cam rods within the cam tube, the axes of the second straight sections

of the cam rods can align themselves to one another or can be misaligned with respect to one another up to an angle equal to four times the angle of the cam rod.

37. The invention of any preceding claim, wherein: the first cam rod is rotatably coupled to the second cam rod by a pin and cube universal joint which is supported within a cam tube.

5 38. The invention of any preceding claim, wherein the first cam rod and second cam rod are longitudinally aligned at equal angles within a cam tube.

39. The invention of any preceding claim, wherein the second cam rod is longitudinally aligned with and rotatably connected to the first cam rod by a plurality of bent rods.

10 40. The invention of claim 39, wherein the first cam rod and the second cam rod are connected at equal angles, and the axes of rotation of the first cam rod, bent rods and second cam rod intersect at the pivot points of the first and second shafts and the bisecting plane of the universal joint which is perpendicular to the rotation axes of the coupling means.

15 41. The invention of claims 39 or 40, further comprising a cam tube rotatably supporting the first cam rod and the second cam rod, and whereby the first cam rod, the second cam rod, and the cam tube rotatably support and interconnect the first shaft and the second shaft for causing the second shaft to move at the same angle relative the coupling means as does the first shaft.

42. The invention of any preceding claim, wherein: each ring comprises a plurality of ring segments which are fitted together end-to-end in a manner to mechanically retain the ring segments together.

20 43. The invention of claim 42, wherein the ring segments are quadrants.

44. The invention of claim 43, wherein the quadrants are substantially identical to one another.

25 45. The invention of any preceding claim, further comprising centering means interconnecting the first shaft and the second shaft, the centering means comprising a first cam rod and a second cam rod rotatably coupled to the first cam rod.

46. The invention of any preceding claim, wherein the second cam rod is longitudinally aligned with and rotatably connected to the first cam rod by a plurality of bent rods.

47. The centering device substantially as shown and described herein.

48. The universal joint substantially as shown and described herein.

30 49. The universal connector substantially as shown and described herein.

50. The inventions substantially as shown and described herein.